PROGRIS RIPORT 22

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010830

`itehu:~kotani/glast.itehu/txt/010830.kotani2.riport22`
`http://lheawww.gsfc.nasa.gov/users/kotani/glast/010830.kotani2.riport22.ps`
`http://lheawww.gsfc.nasa.gov/users/kotani/glast/010830.kotani2.riport22.pdf`

1 Have Done

- Released `appfilter ver. 1.1`, a new version of the BGD filter for both BFEM and PDR data.
- Applied the albedo-electron filters to the BFEM data, but the result is not satisfactory.

Both the neutral events and the high trigger rate may be caused by albedo electrons/protons (Mizuno et al. 2001/08/30). Due to the short ACD and the large space between the CAL and the TKR, it is difficult to cut low-energy-electron events similar to photon events from the BFEM data. Can we reduce the ratio of remaining BGD events to triggering events down to $\sim 10^{-4}$?

2 The Filter Set

The latest filter set for BFEM data in the `appfilter ver. 1.1` package is shown in Table 1. It is available at `http://lheawww.gsfc.nasa.gov/users/kotani/glast/bgdfilter/appfilter.1.1.tar.gz`.
A document in
`http://lheawww.gsfc.nasa.gov/users/kotani/glast/bgdfilter`
may help to use the package. In the BFEM-ACD filter, ACD_TileCount is recalculated based on a new threshold value (pedestal + 80 ch). The current definition of the BFEM-ACD filter is not so smart and will be educated in future release. Each step of the albedo filter is to be discussed in detail in following writeup released on Friday.

The effect of the filter set is demonstrated in Table 2. It is not surprising that the hit-pattern, CAL-info, and space-craft-induced-event filters are not working. The definition of some of the NTuples used in the hit-pattern filter are changed. Some of the NTuples used in the CAL-info filter and the space-craft-induced-event filter don't have a meaningful value because the necessary calibration data are not yet released. And the space-craft-induced-event filter probably needs to be fit to the BFEM design.

The albedo-filter is disappointing. Although the albedo filter is so effective for PDR simulation data that the remaining BGD events are reduced to $< 1/10$, the BGD events in the BFEM data are not drastically removed. All steps of the albedo filter except for the first one doesn't cut events much. One of the difference between the BFEM and the PDR data is the geometry. We can not apply an effective filter which cuts low-energy events out of the central four towers to the BFEM data. So it is expected that the final BGD rejection ratio is not so good as that of PDR simulation, $\sim 10^{-4}$, though that is not a very good number. But don't give up. There are several ideas to be implemented into the albedo-filter, say, detection of bremsstrahlung signal in the TKR. After the tuning up of the parameters of the albedo filter and of the CAL-info filter, we expect an improvement.

Though these filters seem complicated, there are only three major effective cuts. An event is kept if it is not vetoed by the ACD (BFEM-ACD), and if the photon track is reconstructed (Track Quality), and if it deposits an energy (Albedo_e 0). However, these three cuts are not enough to cope with the albedo electrons/protons. We must develop a satisfying albedo-electron filter to extract photons from the BFEM data. To be continued.

3 To Do

- Study the remaining events carefully. `EventDisplay`? `bfemApp`? I think that we can find a way to cut electrons.
- Rewrite Riport 21 and distribute.
- Be out for a week. Return on 01/09/10.

References

[1] Kotani 2001/07/25, Riport 18, http://lheawww.gsfc.nasa.gov/users/kotani/glast/010725.kotani2.riport18.ps

[2] Mizuno et al. 2001/08/30, http://www.slac.stanford.edu/~mizuno/GLAST/Presentation/vrvs_2001-08-30.pdf

Table 1: BGD filter set for BFEM in appfilter ver. 1.0

These definitions/codes are under development and subject to change. `filter()` returns an array of Aux_CutFlag with a size equal to the number of the events. If a filter finds a BGD event which doesn't meet the condition below, the corresponding bit of Aux_CutFlag is set to be 1. If you apply appfilter ver. 1.1 for PDR data, a different logic set is applied. See Table 5 in Riport 18 or following writeup for the definition of the filter set.

Name	Aux_CutFlag	Code/Definition
L1T	2^0	Omitted
L2T	2^1	Omitted
L3T	2^2	Omitted
BFEM ACD	2^{14}	ACD_TileCount $= 0$
New DOCA	2^{16}	Omitted
Hit Pattern	2^{17}	REC_Surplus_Hit_Ratio > 2.25 $\|\|$ (Cal_Energy_Deposit $> 10^3$ && TKR_First_XHit > 13) $\|\|$ Cal_Energy_Deposit $> 5 \times 10^3$
CAL Info	2^{18}	{Cal_Xtal_Ratio>0.25 $\|\|$ Cal_No_Xtals < 1} && {(Cal_Energy_Deposit $< 10^3$ && Cal_Fit_errNrm $< 10.$) $\|\|$ Cal_Fit_errNrm $< 4.$ $\|\|$ Cal_No_Xtals <1}
Track Quality (Jose's filter)	2^{19}	TKR_qual $> 10.$ && TKR_Gamma_zdir $\neq 0.$ && {(Cal_Corr_Energy > 0 && TKR_t_angle $<$ kalfit && $\|$TKR_Fit_Kink$\|$ $<$ kalfit) $\|\|$ (Cal_Corr_Energy ≤ 0 && TKR_t_angle $- \frac{35}{\|\text{TKR\_Gamma\_zdir}\|} < 0$ && $\|$TKR_Fit_Kink$\|$ $- \frac{35}{\|\text{TKR\_Gamma\_zdir}\|} < 0$)} kalfit $= 3.5 \times 10^{-3} \times \left(\frac{3.0}{\text{Corr\_Energy}\,\|\text{TKR\_Gamma\_zdir}\|} + \frac{2.18}{\sqrt{\text{Corr\_Energy}}\,\|\text{TKR\_Gamma\_zdir}\|}\right)$
S/C Ind. Ev. Cuts 0	2^{20}	{ Cal_Energy_Deposit $= 0$ $\|\|$ (Cal_eLayer7/Cal_Energy_Deposit<0.08 $\|\|$ Cal_eLayer0/Cal_Energy_Deposit > 0.25 $\|\|$ Cal_Energy_Deposit > 350 $\|\|$ Cal_No_Xtals < 1)}
S/C Ind. Ev. Cuts 2		&& {Cal_No_Xtals_Trunc<20. $\|\|$ Cal_Energy_Deposit$> 75 \times 10^3$ $\|\|$ TKR_First_XHit<12}
S/C Ind. Ev. Cuts 3		&& {Cal_Z$> -30.$ $\|\|$ Cal_No_Xtals<1}
Albedo_e 0	2^{21}	Cal_Energy_Deposit > 100 $\|\|$ ACD_TileCount $= 0$
Albedo_e 1	2^{22}	Incident γ is reconstructed
Albedo_e 2	2^{23}	The projection of the best track hits CAL && The projection of the pair track hits CAL
Albedo_e 3	2^{24}	Cal_Energy_Deposit > 100 $\|\|$ TKR_First_XHit< 11 $\|\|$ TKR_First_XHit> 14
Albedo_e 4	2^{25}	(best track vector $\cdot$ pair track vector)> 0.5

Table 2: Effect of appfilter ver. 1.1

The "each" column shows the effect of each filter if applied solely. The "accumulative" column shows the accumulative effect of all the filters. The "all but" column shows the effect of all the other filters without it. All ratios are to the number of events triggering L1 of 104820.

Run 53

filter	each		accumulative		all but	
	#	Ratio	#	Ratio	#	Ratio
L1T	30530	1	30530	1	268	0.00877825
BFEM ACD	3579	0.117229	3579	0.117229	732	0.0239764
Hit Pattern	30530	1	3579	0.117229	268	0.00877825
CAL Info	30530	1	3579	0.117229	268	0.00877825
Track Quality	23362	0.765215	2230	0.0730429	1020	0.0334098
S/C Ind. Ev. Cuts	30530	1	2230	0.0730429	268	0.00877825
Albedo_e 0	3340	0.109401	285	0.00933508	1995	0.0653456
Albedo_e 1	29610	0.969866	285	0.00933508	268	0.00877825
Albedo_e 2	24676	0.808254	269	0.00881101	284	0.00930233
Albedo_e 3	30530	1	269	0.00881101	268	0.00877825
Albedo_e 4	30455	0.997543	268	0.00877825	269	0.00881101

Run 54

filter	each		accumulative		all but	
	#	Ratio	#	Ratio	#	Ratio
L1T	109867	1	109867	1	1116	0.0101577
BFEM ACD	12324	0.112172	12324	0.112172	4163	0.0378913
Hit Pattern	109867	1	12324	0.112172	1116	0.0101577
CAL Info	109867	1	12324	0.112172	1116	0.0101577
Track Quality	59450	0.541109	5036	0.0458372	4452	0.0405217
S/C Ind. Ev. Cuts	109867	1	5036	0.0458372	1116	0.0101577
Albedo_e 0	22901	0.208443	1231	0.0112045	4115	0.0374544
Albedo_e 1	101737	0.926001	1231	0.0112045	1116	0.0101577
Albedo_e 2	76865	0.699619	1122	0.0102123	1225	0.0111498
Albedo_e 3	109867	1	1122	0.0102123	1116	0.0101577
Albedo_e 4	109465	0.996341	1116	0.0101577	1122	0.0102123

Run 55

filter	each		accumulative		all but	
	#	Ratio	#	Ratio	#	Ratio
L1T	104820	1	104820	1	487	0.00464606
BFEM ACD	10075	0.0961172	10075	0.0961172	1815	0.0173154
Hit Pattern	104820	1	10075	0.0961172	487	0.00464606
CAL Info	104820	1	10075	0.0961172	487	0.00464606
Track Quality	60485	0.577037	4557	0.0434745	2463	0.0234974
S/C Ind. Ev. Cuts	104820	1	4557	0.0434745	487	0.00464606
Albedo_e 0	14332	0.13673	575	0.00548559	3545	0.0338199
Albedo_e 1	96314	0.918851	575	0.00548559	487	0.00464606
Albedo_e 2	68973	0.658014	493	0.0047033	569	0.00542835
Albedo_e 3	104820	1	493	0.0047033	487	0.00464606
Albedo_e 4	104427	0.996251	487	0.00464606	493	0.0047033